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Reading Comprehension following Training Learning-Disabled Adolescents to Use Adjunct Aids

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Running Head: Comprehension following Training

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Abstract

Research has shown that university students' reading comprehension can be improved by exposing them to adjunct questions. Unfortunately, the way readers cognitively mediated these instructional stimuli was not controlled in these studies. This study tested the affects of pre-paragraph questions, post-paragraph questions, declarative summary statements, or no adjunct aid on learning-disabled students' comprehension following explicit training about how they were to cognitively mediate the adjunct. A second factor of text review was factorially crossed with these conditions. Results indicated that the adjunct aids did not exert any substantial effects on the reading comprehension of the learning-disabled adolescents. However, there was a marked effect of the review variable. The results were interpreted according to a model of learning from instruction proposed by Winne. Methodological suggestions for future studies of reading comprehension are offered. Review of materials as an important remedial focus for learning-disabled adolescents is implied.

Problems of reading comprehension in learning-disabled students are a major concern. Many explanations for these students' comprehension problems have been proposed. These range from decoding problems (Perfetti & Lesgold, 1978) and a lack of basic comprehension skills (Durkin, 1977; Hansen, 1978) to insufficient self-monitoring of one's state of comprehension (Baker, 1978; 1979). Although we are interested in and engage in researching causes of learning-disabled students' comprehension problems (cf. Wong & Jones, 1981), we are equally interested in ways of alleviating their comprehension problems. One purpose of this study was to examine whether adjuncts to text, such as inserted questions and summary statements, could ameliorate learning-disabled students' comprehension problems.

A second purpose of this research was to apply a model for doing research on instruction recently proposed by Winnee (1980). According to this model, the effect of an instructional stimulus that the theorist operationalizes in structural terms, e.g., placing a question about a paragraph's main point immediately following the paragraph, is mediated by at least four cognitive events. In this study, we attempted to control these cognitive events directly to increase the internal validity of this experiment, equating our nominal instructional stimuli to learning-disabled readers' functional instructional stimuli (cf. Rothkopf, 1976; Underwood, 1963).

Numerous studies have demonstrated the effectiveness of adjunct questions in enhancing reading comprehension in college and high

school students (Anderson & Biddle, 1975). Several studies have interpreted increased performance when text is augmented with adjunct questions as readers attention on task-relevant information during studying and the enhancing the links between encoded information and cues provided on related criterion tests (Alessi, Anderson, & Goetz, 1979; Armbruster & Anderson, 1980; McConkie, Raynor, & Wilson, 1973; Reynolds, Standiford, & Anderson, 1979). These studies indicated that when students studied relevant text units instead of irrelevant units, their inspection times on relevant units increased compared to that for irrelevant units. Moreover, longer inspection time, which is presumed to indicate more cognitive effort or concentration on the main task, correleated positively with performance on corresponding test items. These findings imply that focussing the reader's attention on important textual units induces more active or "deeper" processing (Craik & Lockhart, 1972), in the sense that the reader actively interacted with and elaborated the information. The resultant richer network of information is theorized to enhance the retrievability of the information conveyed in the text (Gagne, 1979; Paris & Lindauer, 1977). Consequently subjects' performance on criterion tests improves.

In attempting to generalize how normally-achieving university students may use and profit from adjunct questions to the use of these adjuncts by learning-disabled students, several points need to be considered. First, learning-disabled children typically exhibit attentional deficits, especially in selective attention (Hallahan, 1975; Hallahan & Kauffman, 1976; Ross, 1976; Tarver & Hallahan, 1974). Hence,

placing adjunct questions before paragraphs (preparagraph questions) to direct readers' attention to key information may enhance the extent to which learning-disabled students attend to the questions themselves and to the concepts they reference in the paragraph that follows. However, the facilitative effects of pre-paragraph questions on learning-disabled student's reading comprehension may not be presumed. The burden of extra processing imposed by preparagraph questions may strain the learning-disabled student's capacity in working memory (Kluever, 1971) as he or she begins to read and attempt to comprehend the text. To accommodate increased attentional processing demanded by the adjunct questions, other processes central to comprehension may suffer. For example, the learning-disabled student may not attend to elements of the paragraph not directly cued by the question, thereby decreasing incidental learning and its contribution to elaborating the cognitive structure containing information from the text. Thus, while intentional learning may improve, the overall effect of preparagraph questions may be to depress comprehension of the full text.

Regarding the use of adjunct questions that follow the paragraph, it has been well substantiated that these facilitate intentional learning in normally-achieving students without depressing incidental learning (Anderson & Biddle, 1975; McGraw & Grotelnschen, 1972; Rothkopf & Billington, 1974). The facilitative effects of post-paragraph questions also have been interpreted in terms of increased processing of thematically important text information. We believe

post-paragraph questions may exert similar facilitative effects on the learning-disabled student's reading comprehension. When the question follows the passage, the learning-disabled student will not be prompted to engage in extra processing to answer the question during reading per se, and may be able to use whatever text elements were comprehended from the passage to make sense of and process thematic elements dealt with in the question. These combinatorial effects may enhance comprehension.

However, as in the case of preparagraph questions, this facilitative effect of post-paragraph for learning-disabled students may not be presumed. Specifically, if the learning-disabled student has failed to isolate key points in the paragraph due to selective attentional deficits, the thematic elements referenced by the questions will not be available for integrative processing. Thus, they will be no better off than were the questions omitted. This reasoning follows Andre and Sola's (1976) finding that semantic encoding via post-paragraph questions was most effective when the material to be learned was reviewed by learners. The availability of text passages for review following the presentation of post-paragraph adjunct questions has not been examined with learning-disabled students. It is hypothesized, however, that review may be a critical variable for them to insure they have access to critical items in the text that need to be processed to achieve comprehension.

Finally, one may legitimately ask whether learning-disabled students will profit from any instructional treatment that adds to

processing demands. Adjunct questions, whether before or after text paragraphs, are intended to engage the reader in extra processing of thematically important elements. Cues to engage additional processes may compound an already demanding task for the learning-disabled reader to the overall detriment of comprehension. Rather than trying to induce extra processing, it may be better to make use of the simpler and powerful relation between rehearsal and learning. In other words, simply repeating at the end of a paragraph a paraphrased summary statement of the thematically important elements referenced by adjunct questions may facilitate comprehension. Attempts to comprehend the paraphrased statement may induce deeper processing by learning-disabled student, thereby enhancing comprehension. At the very least, the repetition of thematically important elements provides an additional opportunity for the students to attend to the main idea. This may remedy selective attentional deficits while not adding attentional or other processing demands required by adjunct questions.

The foregoing analysis leads to several questions. First, the degree to which learning-disabled students can profit from adjunct questions, placed either before or after paragraphs, is unknown. Depending on the potential trade-off between focussing selective attention and adding processing demands to already taxing reading comprehension tasks, the effects of these instructional stimuli may not parallel those for normal readers. Thus, one purpose of this study was to explore the generalization of adjunct questions effects

to this special population. By contrasting the effects of pre-paragraph and post-paragraph adjunct questions with a cognitively simpler post-paragraph summary statement, it should be possible to examine the nature of this trade-off.

A second issue explored in this study is the effect of review on learning-disabled students' comprehension. If adjunct questions of either type are deleterious due to the additional demands they impose on cognitive processing, it may be that this disadvantage can be reversed when learning-disabled readers review the reading materials. This could result because, first, rehearsal facilitates encoding and, second, because adjunct questions may not over-burden processing devoted to comprehension per se when partial comprehension achieved from the first exposure to the text can support further processing. Under these conditions, comprehension may be greatly enhanced. Thus, a second objective of this study was to explore this possibility by contrasting learning-disabled students' comprehension of texts augmented by adjunct questions or summarizing statements when review was provided versus when it was not.

The valid interpretation of the theoretical effects of these manipulations depends on how students actually respond to the independent variables. Specifically, in order to increase the construct validity of putative causes (see Cook & Campbell, 1979), there must be some assurance that the experimental variables function as they are theorized. For example, if the nominal independent variable is a pre-paragraph adjunct question, valid interpretation of how this

instructional stimulus influences comprehension requires some evidence that it actually functioned to engage readers in selective attentional processing of central ideas as they read the following paragraph.

Winne (1980) has argued that four sources of variance should be accounted for in attempts to research the effect of instructional stimuli, like adjunct aids, on learning. First, one must be sure that the learner perceives the presence of the instructional stimulus. Second, it must be documented that the learner understands what is to be done cognitively in response to the instructional stimulus. Third, one must assume that the learner has sufficient motivation to actually engage these cognitive processes. Fourth, the learner must make use of the products of these cognitive operations cued by the instructional stimulus in learning per se.

In this study, we attempted to insure that the learning-disabled students could perceive, understand, and carry out the cognitive operations hypothesized to facilitate learning in the presence of each of the three kinds of adjunct aids. Specifically, we trained them about what to do when they encountered each adjunct and described how this would aid in learning. This training was intended to address directly the problem of learning-disabled adolescents' deficits in the selective attention they apply to learning from text. We hypothesized that once these deficits in selective attention were lessened, these students would be capable of executing the processes needed to learn the material they had identified. In other words, we attempted to insure that the nominal cues provided by adjunct aids functioned as

theories of instruction say they should.

Method

Participants

A total of 109 students participated in the study. They comprised an approximately equal number of students from grades 7 and 8 students in two suburban school districts in the 1978-79 school year. They were randomly selected to participate in the study from the population of learning-disabled students in these grades from the two districts. All were classified as learning-disabled by their school district. The criteria these districts used to classify a student as learning-disabled were: (1) one to two years below grade level in reading comprehension as measured by either the Gates-MacGinitie or Nelson-CTBS reading tests; (2) no clinical diagnosis of emotional disturbance; (3) no sensory deficit; (4) at least second generation Canadian or English was the family's spoken language.

Training: To equate the nominal independent variables with students' use of these instructional stimuli, all students who received text augmented by adjuncts (i.e., preparagraph questions, post-paragraph questions, or summarizing statements) were instructed about how to respond to the adjunct. This training was carried out prior to the experiment using two passages titled "Food for Healthy Living" and "Climates." Below are reproduced the instructions and activities of this training session for students assigned to the various text plus adjunct conditions. All students in these conditions received this

introduction. Items in parentheses were varied to correspond to the appropriate text format. "When you read, it is very important that you understand what you have read in order to remember the ideas in the passage. I am going to teach you how to use review questions (statements) that come after (before) a paragraph. Let's start by reading the article titled "Food For Healthy Living."

This introduction was followed by one of the following elaborations depending on the text format. For students provided texts augmented by preparagraph questions, the trainer continued: "Before each paragraph, you will find a question. The answer to this question can be found in the paragraph that follows. If you try to answer the question as you read the paragraph, you will understand and remember more of each article that you read." In the post-paragraph question condition, the trainer said: "At the end of each paragraph you will find a question. After we have read the paragraph, I would like you to carefully read the question, then hunt back through the paragraph and find the answer to the question. If you do this for each question you will find that you will understand and remember more of each passage that you read." Finally, in the post-paragraph statement condition, students were told the following: "At the end of each paragraph you will find a statement which summarizes the paragraph. After we have read the paragraph I would like you to carefully read the statement and then hunt back through the paragraph and find the ideas in the review statement. If you do this for each statement you will find that you will understand and remember more of each passage

that you read. At the conclusion of each of these introductions, the trainer said: "I would like you to read silently while I read the article aloud."

After the trainer and students finished reading the first paragraph in the article "Food for Healthy Living," students were given time to find the answer (idea) referenced in the adjunct. Then a volunteer was asked to tell his answer (idea) to the others. His answer (idea) was discussed to be sure the students understood why the answer (idea) was right or wrong. Any errors were corrected. The students were then asked if they had any questions. After the questions were answered the next paragraph was read. This procedure was repeated for each paragraph in this article.

After this article had been presented and discussed, the trainer read the following script: "In the next exercise titled 'Climates', I would like you to use the questions (statements) as you did in the last article. However, rather than telling me the answer, would you please underline the answers (important ideas). When you are finished, please write your name at the top of the page and I will come around and make sure you understand how to use the questions (statements)." The trainer then gave each student individual feedback on their response and presented correct answers to the group as a whole. When this article had been collected the following was read: "Next time and in the other times we will meet, I'm going to ask you to read some short articles that also have questions (statements). I think

you will find that by using the questions (statements) as we have done today, you will understand and remember the articles especially when you try to answer the question I'll give you when finished reading. Do you have any final question? Well, then, Thank-you and I will see you on _____."

The students in conditions without an adjunct aid were instructed to read their articles carefully and be prepared for subsequent tests. They also were instructed to seek help over any decoding and/or vocabulary difficulties.

Students assigned to the review condition were instructed to reread the paragraphs in the articles to make sure they had learned the information. The opportunity for reviewing the materials was denied students in the no-review condition.

Materials: The passages on which students were tested consisted of four sequential lessons adapted from a previous study of teaching effectiveness (Clark, Gage, Marx, Peterson, Stayrook, & Winne, 1979; Winne, 1977). They were titled Ecology, Energy in the Ecosystem, The Flow of Energy in the Ecosystem, and Matter in the Ecosystem. Four variations of these materials were prepared to correspond to the four text formats investigated in this study. A multiple-choice test on each passage was constructed containing 12 4-option items each.

Design and procedures: Students were randomly assigned to one of eight conditions defined by a 2 (review) x 4 (text format) design that crossed review vs. no review with one of four text formats:

preparagraph questions, post-paragraph questions, post-paragraph summary statements, and plain text. Within each school building, sessions for each group were run independently. Groups of no more than seven students met on alternating days (i.e., Monday-Wednesday or Tuesday-Thursday) for one training session and four read-test sessions.

At each of the read-test sessions, students were instructed to read that day's text carefully to prepare for a test. Immediately after each student had finished reading, they were administered the multiple-choice test on that day's material. Feedback about their answers was not provided during the study.

Results

The students' scores on tests covering the four passages were analyzed initially using a 2 x 4 multivariate analysis of variance which treated total scores on each of the four multiple-choice tests as four dependent variables. Using the BMD IIV program (Dixon, 1974), statistical tests of main effects were carried out on dummy coded vectors that contrasted the review and the no-review conditions, and each of three adjunct conditions with the control condition. Interaction effects were tested using cross-products of these vectors.

Statistical tests on each of these vectors revealed only one statistically reliable source of variance, the interaction of review with the contrast between post-paragraph questions and the control condition ($\underline{U}_{4, 1, 101} = .96$; approximate $\underline{F}_{4, 98} = 4.15$, $\underline{p} < .01$).

This finding was followed by four univariate 2 (review vs. no review) by 2 (post-paragraph questions vs. control) analyses of variance on test scores from each of the four passages from the 58 students in these cells of the design. On passage one, statistically reliable Review x Post-paragraph interaction was obtained ($F_{1, 54} = 12.75$, $p < .001$). The mean scores on the multiple-choice test were distributed as follows: 6.00 (Review with Post-paragraph Questions); 8.47 (Review with No Post-paragraph Questions); 7.46 (No Review with Post-paragraph Questions); and 5.60 (No Review with No Post-paragraph Questions).

On passages two, three, and four, the analyses of variance yielded a consistent main effect for the review condition. The respective F-statistics with 1 and 54 degrees of freedom were: 7.13 ($p = .01$), 4.82 ($p = .03$), and 4.62 ($p = .04$). In each case, students who reviewed their text outscored those denied review. The respective means for the passages were: 5.33 and 4.33 for passage two, 5.03 and 3.86 for passage three, and 5.27 and 4.32 for passage four.

Discussion

The purpose of this study was to investigate the facilitative effects of various adjunct aids on reading comprehension in learning-disabled adolescents. Additionally, we were interested in how the adjunct aids interacted with the opportunity to review materials. Also, we trained the learning-disabled students to perceive, understand,

and carry out operations that were hypothesized to facilitate learning when the texts they read contained one of the three kinds of adjunct aids. Specifically, this training was intended to lessen learning-disabled adolescents' deficits in selective attention applied to learning from text. It also was intended to increase the correspondence between the nominal independent variables and functional stimuli to which the students responded. We assumed that, having accomplished these first three cognitive tasks entailed in learning from instruction, that they would be capable of executing learning processes to store information in their cognitive structure.

The adjunct aids used did not exert any consistently reliable effects on the comprehension of the learning-disabled adolescents in this study. However, the facilitative effect of review on these students' comprehension was clearly demonstrated. These results show that even when learning-disabled students have been explicitly informed of the function of adjunct aids and practiced their use, these aids exerted little impact on their comprehension. Assuming that these students had, in fact, mastered the cognitive processes cued by these instructional stimuli so as to lessen their selective attentional deficits, then the failure of these instructional stimuli to enhance comprehension has two possible interpretations. On the one hand, since selective attentional deficits had been lessened and since comprehension was not facilitated, the results suggest the possibility that selective attention was not the problem faced by these learning-disabled readers. Instead, it would appear that their

problem was executing the learning processes per se that take selectively identified information and place it in cognitive structure in a retrievable form. If this hypothesis is true, we trained these students to remediate a non-problem. That there were no reliable differences in the scores of the control group and the adjunct aid groups that were all denied review support this speculation.

On the other hand, it may be that the training we provided learning-disabled students in using adjunct aids was effective and, in fact, lessened the impact of their selective attentional deficits. This assumption leads to the interpretation that even with explicitly identified information to learn, these students were unable to engage effectively the learning processes necessary to store information in cognitive structure in a retrievable form. According to this speculation, the training about how to use instructional stimuli to enhance comprehension ameliorated only three of the four problems faced by learning-disabled readers. Further instruction about how to carry out learning itself may have been required to enhance comprehension.

This latter speculation received some support from the relatively consistant finding that review of materials enhanced comprehension irrespective of the presence or absence of adjunct aids. Practice or rehearsal is a well known facilitator of learning. When the learning-disabled students were allowed to review materials, reliable increases in their comprehension were obtained. Thus, to the extent that review of information is one learning process that must be engaged in order

to store selectively identified concepts in cognitive structure for later retrieval, it follows that the learning-disabled students who made use of the adjunct aids faltered in at least this respect. In other words, had we trained them to engage in rehearsal on their own, rather than forcing them to, we may also have attended to the fourth essential component of learning from instruction.

Alternatively, learning-disabled adolescents may need more than two practice passages to learn to apply adjunct aids in processing prose. We did not obtain evidence that the learning-disabled adolescents were using the adjunct aids to focus their attention on relevant elements in the text. We assumed that two practice passages sufficed. This potential error may account for the lack of treatment effects concerning the adjunct aids.

On the positive side, the findings highlight the role of review of materials in promoting learning-disabled adolescents' performance. We concur with Andre and Sola's (1976) explanation of the importance of review in that it allows learning-disabled students to reprocess the materials for meaning. These positive findings for review of materials read have important implications for remedial instruction.

Finally, it would be premature to conclude from these results that adjunct questions or post-paragraph statements do not promote reading comprehension in learning-disabled adolescents. Had we insured that our learning-disabled readers matched their cognitive processing to the texts with the given adjunct aids, we believe they would have substantially increased their comprehension performance,

(cf. Winne, 1981). This belief, however, awaits further empirical research.

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